device layer 4) were grown by the same method as in Example 1 except that the composition of the superlattice was ($Al_{0.35}Ga_{0.65}As$/GaAs:Si). The dislocation density of the epitaxial crystal layer (optical device layer 4) was evaluated according to PL mapping, to find a value of 202 cm^{-2}.

Example 11

Buffer layer 3 and the epitaxial crystal layers(optical device layer 4) were grown by the same method as in Example 10 except that the Si doping concentration was 1×10^{18} cm^{-3}. The dislocation density of the epitaxial crystal layer (optical device layer 4) was evaluated according to PL mapping, to find a value of 627 cm^{-2}.

Example 12

Buffer layer 3 and the epitaxial crystal layers(optical device layer 4) were grown by the same method as in Example 10 except that Si doping was not conducted. The dislocation density of the epitaxial crystal layer (optical device layer 4) was evaluated according to PL mapping, to find a value of 1470 cm^{-2}.

Example 13

Buffer layer 3 and the epitaxial crystal layers(optical device layer 4) were grown by the same method as in Example 1 excepting the following points in the Si doping method. In the Si doping, the $Al_{0.2}Ga_{0.8}As$ layer 31 was grown, then, planar-doping was effected at a concentration of 1×10^{12} cm^{-2}

at the interface with the following GaAs layer 32, subsequently, the GaAs layer 32 was allowed to grow. The dislocation density of the epitaxial crystal layer (optical device layer 4) was evaluated according to PL mapping, to find a value of 138 cm^{-2}.

Example 14

Buffer layer 3 and the epitaxial crystal layers(optical device layer 4) were grown by the same method as in Example 1 except that the dislocation density of the GaAs substrate used was about 50000 cm^{-2}. The dislocation density of the epitaxial crystal layer (optical device layer 4) was evaluated according to PL mapping, to find a value of 550 cm^{-2}.

Comparative Example 1

As shown in Fig. 2, in a 3-5 group compound semiconductor 1' produced by growing the optical device layer 4 directly on the GaAs substrate 2 without providing the buffer layer 3 having a laminated structure for reducing the dislocation density, the dislocation density of the optical device layer 4 was evaluated according to PL mapping. Here, the constitution for the GaAs substrate 2 and the optical device layer 4 were the same as in Example 1, as a result, the dislocation density of the optical device layer 4 was 3400 cm^{-2}. It is known from this Comparative Example 1 that the dislocation density of a epitaxial crystal layers grown on the GaAs substrate 2 can be remarkably reduced by providing the buffer layer 3. Further, it is also known that the dislocation density can be further reduced by

doping Si into the buffer layer 3 and selecting a suitable value of this doping concentration.

Thus, by providing the buffer layer 3, or by doping an n-type dopant into the buffer layer 3 in addition to this, propagation of dislocation into an upper layer can be effectively prevented, consequently, the dislocation density of an epitaxial crystal layers grown on the GaAs substrate 2 can be decreased even if a GaAs substrate 2 having large dislocation density is used. Therefore, if this constitution is used in production a optical device such as a light-emitting element, degree of freedom in selecting substrates increases, and the produced light-emitting element can be endowed with longer life and high reliability, further, an element excellent in properties having high light-emitting efficiency can be realized.

Referential Example 1

The 3-5 group compound semiconductor epitaxial multi-layers having the structure shown in Figure 3 were fabricated on the (100) surface of a GaAs substrate by means of OMVPE. Five pairs of superlattice each pair composed of an $Al_{0.2}Ga_{0.8}As$ layer of 50 nm and a GaAs layer of 50 nm were grown onto a GaAs layer of 150 nm. Further, a HEMT structure having an electron transporting layer of $In_{0.22}Ga_{0.8}As$ layer of 14 nm was grown thereon for the PL measurement.

The presence of misfit dislocations caused by the lattice mismatch between the $In_{0.22}Ga_{0.8}As$ layer and each adjacent